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Sampling Potatoes for Starch Analysis

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In the determination of starch in fresh potato pulp the question frequently arises as as to how the sample for analysis should be taken. Sometimes it is considered necessary to use as many as ten or more tubers in order to get a composite sample that is representative. If the entire tubers are crushed, a large amount of pulp is obtained which, in itself, presents another sampling problem. In order to overcome this difficulty, the tubers are often sampled by boring diagonally from stem to bud end with a cork borer to get cores of the same diameter. The cores thus obtained are later crushed in a press and the pulp thoroughly mixed. This method of obtaining a sample has several distinct advantages in its favor. It is rapid, requires little effort, and gives an amount of pulp that can be readily and thoroughly mixed and sampled. However, on account of the structure of the potato, there is reason to believe that it does not always give a sample that is representative.

Studies made on the composition of the potato have shown that there is a concentration of starch and dry matter in the cortical layer, that the outer medullary portion is intermediate both in starch and dry matter, and that the inner medullary is comparatively low in starch and dry matter.[1] It has been observed that there is but slight increase in thickness of the cortical area with size of tuber and that the greatest enlargement comes about in the medullary, the portion of low starch and dry matter content. It is obvious, then, that a core from a potato of small diameter should show a relatively higher percentage of cortical area and also a higher percentage of starch

and dry matter than a core from a tuber of larger diameter. Sampling by cores does not take into account the distribution of the starch in the potato and as a result the percentage of starch in the sample is likely to decrease as the size of tubers selected for the sample is increased. With this thought in mind, the following experiment was conducted.

Three groups of ten potatoes each were selected from a crop of Irish Cobblers that had been grown without fertilizer at Presque Isle, Maine. The groups in respect to size were what might be termed large, medium and small. The first group contained tubers from 60-65 gr. (mean 62.8 gr.), the second group 120-125 gr. (mean 122 gr.), and the third group 165-170 gr. (mean 167.8 gr.). The potatoes selected were sampled diagonally from bud to stem end with a cork borer about 1.75 cm. in diameter. Then sections approximately one centimeter long were cut from both ends of each core, constituting the cortical area. A composite for each group was made from these sections, leaving the remainder of the cores to be used for the sample of medullary. All samples of both medullary and cortical areas were crushed separately in a press and the pulp obtained thoroughly mixed. The remaining portion of the tubers in each group, after the core sample was taken, was cut in small sections and crushed in a similar manner. Analyses for starch, using the saccharimeter method of Franz Herles[2] were made in duplicate on all samples. Dry matter was determined concurrently with percentage of starch. The results of these determinations, together with the total weight of pulp for the samples, are given in Table I. In the last two columns of the table are found the calculated percentage of starch based upon the results for both cortical and medullary areas corresponding to the starch value for the entire core crushed in one operation, and the calculated percentage of starch for the entire tuber.

A decrease in percentage of starch in the medullary area of the larger tubers is clearly shown in Table I. This reduction amounted to almost 3 per cent between Group 1 and Group 3, accompanied by a corresponding decrease in dry matter in the same area. On the other hand, the percentage of starch and dry matter in the cortical area remained fairly uniform. It will be observed that these figures for the cortical area are considerably higher than those for the medullary of each corresponding group, the increase over medullary for starch being about 4, 5 and 7 per cent and for dry matter 4, 6 and 7 per cent for Groups I, II and III respectively. Accordingly, a sample made up of whole cores from tubers in Group I should give a higher percentage of starch than a similar sample from Group II, which, in turn, should be higher than the result from Group III. The figures representing the calculated percentage of starch in the cores in Table I show this to be the case. The

TABLE I. Results of Analyses on Cortical and Medullary Areas of Potato Cores and Remainder of Tuber

GROUP	Cortical Area			Medullary Area			Remainder of Tuber			Calcul. % Starch in Core	Calcul. % Starch Entire Tuber
	Weight	% Starch	% Dry Matter	Weight	% Starch	% Dry Matter	Weight	% Starch	% Dry Matter		
I (60-65 grams)	46.7	21.3	27.4	86.9	17.4	23.5	494.8	20.8	27.7	18.7	20.36
II (120-125 grams)	49.4	21.0	27.1	125.0	16.2	21.7	1045.6	20.4	26.7	17.6	19.99
III (160-165 grams)	51.4	21.7	27.9	133.0	14.7	20.4	1493.6	20.4	26.8	16.6	19.98

ratio of cortical to medullary area in the sample cores evidently affects the percentage of starch obtained, this ratio, of course, being a function of the size of tubers used.

Another indication of the disadvantage of the core method of sampling may be seen by comparing the calculated percentage of starch in the cores as given in Table I with the results obtained where the remainder of the tuber was crushed and analyzed after the sample cores had been taken. The figures for the analysis of the remainder of tuber are considerably higher and very uniform in comparison with the calculated results for the cores. A similar comparison may be made with the calculated percentage of starch in the entire tuber. Obviously the error in the core method varies directly with the size of potato selected for the sample.

That results of a converse nature would likely occur in the case of nitrogen determinations on these samples is very probable, since the nitrogen content of the medullary is relatively higher than that of the cortical area.[1] This reverse relationship would tend to make the percentage of nitrogen in the cores higher than that of the entire tuber in contrast to the lowering effect on the percentage of starch by the same method of sampling.

In an attempt to compare other methods of sampling with core method, starch determinations were made on samples prepared by quartering potatoes of different sizes. These results were compared with those obtained by using the remaining three-quarters of the potato. For this work, three groups of ten tubers each were selected for sampling. The tubers in the first group had a mean weight of 28.8 gr., the second group 77.4 gr., the third group 128.0 gr. Five tubers in each group were quartered along the vertical axis, i. e., bud to stem end, and one quarter of each tuber was selected and crushed, the remaining three-quarters being crushed in a similar manner. The five other tubers in each group were sampled by the core method. Starch determinations were made on all samples, using the Herles Saccharimeter Method. Dry matter was run on the samples as usual. The results recorded in Table II show close agreement between percentage of starch and also dry matter in the quartered and entire samples regardless of the size of potato used. However, the error in both percentage of starch and dry matter in samples made by the core method is apparent.

From the data presented it would seem that a quartering method of sampling is to be preferred to that using cores. This is especially true when analyses are being made on potatoes from fertilizer experiments including no-treatment plots, since the latter usually produce relatively small tubers either the first or succeeding years of the experiment.

TABLE II. Effect of Size on the Percentage of Starch and Dry Matter in Tubers Variously Sampled.

GROUPS	Percentage Starch			Percentage Dry Matter		
	Core	Quart	Entire	Core	Quart	Entire
28.8 gr.	17.7	18.5	18.5	23.11	24.60	24.77
77.4 gr.	16.8	18.0	18.1	22.26	23.98	24.08
128.0 gr.	14.6	17.1	17.1	20.45	23.15	23.10

REFERENCES

[1]Coudon, Henri and Bussard, Leon (1897) Research on Edible Potatoes. Amn. de la Sci. Agron. tome 1; 2nd Ser. 3d Ann.
[2]Herles, Franz (1912) Eighth International Congress of Applied Chemistry. Vol. 26, page 5.

The Bruising of Potatoes and Its Prevention

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The bruising of potatoes and prevention thereof is a matter which is generally neglected by potato growers and warehouse men. It is so common a source of losses that it is accepted as a necessary evil. While considerable attention has been devoted by the scientific worker to bruising and skin abrasions as factors in the development of storage rots, the admirable knowledge thus gained has failed to a great extent to impress growers with the full importance this question deserves. Potato growers are in a general way practical men and probably with some exceptions do not absorb technical information unless it is presented with all the practical significance it bears to their operations.

It appears that the chief reason why more diligence and careful methods are not employed in the digging, picking, grading and all the necessary incidental operations in the handling of

potatoes, is because of the fact that fresh bruises and abrasions are not apparent to mere casual or superficial observation. It requires close examination of individual tubers both with eyes and fingers to discover the full extent of existing bruises and abrasions. Close examination should be made following the starting of every operation to determine how much care has to be maintained to reduce the injury to the tubers to a practical and efficient minimum.

Only too often the grower is not aware of the mishandling of his crop, and does not observe it, until after a few weeks in storage. The bruises and abrasions dry up, turn dark in color, and likely as not considerable storage rot infection sets in. If he has available proper storage and knows how to handle it, storage rot damage can be held down to a minimum, but the unsightly appearance of the bruises cannot be eliminated except by throwing them out on grading. Nor is it possible to get away from the fact that storage rot infection may be present and upon the sale and shipment of these potatoes, the buyer will probably have trouble from dry rot and consequently dissatisfaction with his purchase. Short periods of storage may not bring out all the damaging effects which bruising produces. Potatoes taken out of temporary storage and put into immediate consumption show but little damage beyond impairment of marketable appearance. The bruised spots starch over, dry up, and when healed are light in color on the surface, but blackened inside and seem comparatively harmless beyond probably making it difficult to grade them U. S. No. 1.

As the time of storage is prolonged bruising becomes strikingly apparent to the grower. Large losses may be sustained through storage rot. Individual growers have practically ruined the finest of potato crops through carlessness in handling, and only to repeat the same in another season due to insufficient supervision of their field help. When the stress of harvesting operations begins, constant vigilance in every operation must be maintained from day to day in order to hold down bruising injuries to a minimum instead of inspecting the kind of work which has been done when it comes time to grade and ship the crop out. This is particularly essential in seed potato production. Many poor stands are caused by seed which has dry rot infection started in bruises.

The causes of bruising and skin abrasion may be considered as being largely of a mechanical nature and necessarily incident to a greater or lesser degree in all the various operations of harvesting and handling the crop. These operations include digging, either mechanical or hand picking, loading and hauling out of the field, placing into storage, or grading, sacking and loading on board cars. Causes which may not be considered purely mechanical will be discussed later.

When the tubers are taken out of the soil, the skin is damp

and offers but little resistance to tearing and slipping as well as contusions of the flesh underneath. The tubers are turgid and if dropped as little as six or eight inches on the edge of a slat in the crate, on the round side of an elevator bar in the digger, or mechanical picker, or from grader into a sack, the flesh will be bruised. The tossing of potatoes by pickers into crates or baskets, or emptying baskets into sacks at some height to permit the potatoes to fall on each other is the most fruitful source of bruising. In moving the potatoes off the field rough handling in setting down the sacks and slinging them around causes damage. Emptying into bins or cellars by dropping from a height has ruined many a lot of fine potatoes.

A reasonably well handled digger of any of the well known makes will produce the smallest proportion of bruising as compared with the total of the remaining operations. In dry or loose soil moderate speed and running the point deep enough to prevent cutting is necessary, as well as enough soil should be moved over the elevator to act as a cushion. The agitator on the elevator may be replaced by a smooth roller except in heavy soil or as conditions may require. The front elevator in some machines may be made continuous with the rear apron, and thus avoid the drop off between the upper end of the front chain and the front end of the rear elevator apron. To keep the knuckles in the bars of the front elevator from damaging those tubers which on rolling downward, strike the knuckles, a four or five inch length of canvas belt may be attached on the inside to cover them unless the digger is already provided with such a shield. The tubers should be left to dry before picking to toughen the skin. If a row deflector is employed on the rear of the digger it should be well padded. Picking is sometimes done by mechanical means in sections where yields are inclined to run light and labor is hard to get to do this type of work. The experience of these growers who have used a mechanical picker is that it is difficult to prevent damage to a reasonable degree even with the exercise of all care possible. Although for potatoes not intended for storage some operators claim it will get by. Elimination of all sharp corners, padding deflectors, etc., must be provided as no satisfactory provisions are made by manufacturers.

The employment of hand picking carefully and intelligently supervised by owner or foreman results in a minimum of bruises sustained in this operation. Without instructions, with due regard to impress on the pickers the ease with which potatoes are bruised and the seriousness of this resulting damage, a slackness and carlessness develops among a crew as to unnecessarily and vastly increase bruising. It is entirely up to the owner to give such necessary instruction and orders, and maintain constant watchfulness to see that the potatoes are not tossed or pitched into either crates or baskets. The rim

of a picking basket may be wound with burlap, or rubber padding. In pouring potatoes from a basket into a crate or sack, it should be done gently and from as little height as possible. When there is no danger from sun scald the potatoes should be allowed to dry in the sun if possible to let the skin harden and toughen.

The same careful attention to handling when hauling off the field must be given. When the potatoes are in crates or in sacks, no rough handling, jamming, throwing around or walking over the top of the load should be permitted.

When placing the crop into storage in bins or cellar suitable and careful provisions must be made to not drop the potatoes through any distance to shatter and bruise the tubers, especially the first ones put in. Canvas chutes can be used with buffers at the lower end. When emptying loads into bins on the same floor level, burlap bags filled with hay can be used to support plank walks. The same principle of precaution should be employed when using conveyors to fill the bins.

Bruising on a grader can be entirely overcome by using a suitable machine and not running it at an excessive speed. The sacker end of the grader should be padded with rubber or burlap and accumulated dirt which hardens should be occasionally cleaned out. If the sacks which are being filled off the grader, rest on a hard floor, padding should be placed underneath, and when loading into cars for shipment the same careful methods of handling must be used.

Potatoes piled up to a great depth, ten to twelve feet, usually develop bruises throughout the tuber. This is evidenced by streaks of black throughout the tissues of the tuber and occurs in the bottom portions of the bin.

It also appears that certain conditions of temperature are conducive towards bruising of the tubers. Late in the fall when the soil becomes quite cold probably around 40° F, or colder, the tubers develop a brittleness so that they will shatter and bruise much more easily than when the ground is warm. It also appears that this is more noticeable on muck soils than on mineral soils.

Often it happens with Triumphs that on exposing them to air and sun out of cold soil one can hear them pop open or split and develop the characteristic nail checks. Strains and stresses appear to be set up in the tuber due to unevenness of expansion of the surface and the interior. When potatoes are handled under such conditions a much larger than normal amount of bruises will be developed. Abrupt changes in temperature such as taking potatoes from storage and loading them for shipment into a heated car will produce characteristic checks. These particular phases of the question should warrant some technical study.

Every grower and shipper should easily see why bruises should be avoided or prevented if possible.

1. Losses and shrinkage from storage rots will be lessened.

2. Losses and shrinkage from throwouts on grading of the crop are minimized. Occasionally potatoes are so badly battered and bruised that it is impossible to put them up to U. S. No. 1 grade, thus causing the additional loss of grade.

3. Bruises spoil the appearance of good potatoes and otherwise detract from their potential marketability. Jobbers and retailers are all quick to realize this. Distinctive quality is the keynote of success in the merchandizing of goods today and it holds for potatoes. Consumptive demand would be increased through preservation of good appearance.

In the formation of our conclusions it appears that the one big factor in prevention of bruises is the personal factor of being keenly aware and alive to the serious damage of the crop through careless handling. The grower should be thoroughly appreciative of the fact that potatoes are easily bruised in any one or all of the harvesting operations and he should pass this idea to his hired help and suitably supervise this labor.

Machinery intelligently handled will result only in a minimum injury. Precautions of making proper adjustments and additions of padding should be made at all points where bruises occur. If the skin is allowed to dry and set for a short time after digging less bruising takes place.

The Importance of Nitrogen in Potato Production

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The proper use of plant food is a good way to increase the farm income. Well-proportioned fertilizer is just as desirable for profitable potato production as is a well-balanced feed for stock. Under-fed potato plants, like animals, return very little profit. Even if any profit should result, it would likely be more than absorbed to meet interest, taxes, seed, cultural and harvesting operations, so that no income would be derived for labor or supervision. Insofar as plant food is concerned, there

is no economy in stinting the potato plants with the expectation that they will yield well on what they can get from the soil alone.

Nitrogen at present is the most expensive plant food element the potato grower has to buy and the most readily lost by leaching and other causes. It is, therefore, of considerable importance that potato growers possess facts not only concerning how much nitrogen to use, but the sources from which it can be most economically obtained as well. This will vary somewhat in accordance with the type of soil, previous treatment, the variety grown, and climatic factors—Chiefly rainfall.

CHANGE TAKING PLACE IN FERTILIZER PRACTICE

The fertilizer industry and the fertilizer consumer alike are facing tremendous changes in fertilizer usage and practice, which applies, for one thing to the materials themselves. This is particularly true of nitrogen materials. Not so many years ago, sodium nitrate from Chile, and ammonium sulphate from the coke and gas industries, were the chief sources of inorganic nitrogen. The chief organic nitrogen sources were fish scrap, tankage, dried blood, cottonseed meal, castor pomace, and calcium cyanamid. The first four of the organic group have become, on account of their utilization for feeding stuffs, somewhat prohibitive in price, and their use in fertilizer mixtures has become less and less in recent years. The fertilizer industry has experienced a marked evolution in what might be termed technical matters. Chemistry has stepped in and, in common with many of its conquests, has brought about marked changes in the development of new fertilizer materials, chiefly those containing nitrogen.

Owing to the fact that nitrogen costs more than the other plant food elements in fertilizer and is more readily lost from the soil, every effort should be made by the grower to increase the supply by suitable rotations and by organic matter. Any available manure is, of course, of value, and in many rotations in which the potato is included, the manure is applied so as to be of direct benefit to the potato crop.

It is also becoming more evident that with the production of so many new nitrogen materials more experimental work is needed to determine their effectiveness in fertilizers in comparison with standard nitrogen materials. While preliminary results indicate the newer materials are as effective as the older nitrogen carriers, a broader scope of experimental work is necessary to determine the relative value of the newer nitrogen products under different soil and climatic conditions.

COOPERATIVE FERTILIZER INVESTIGATIONS

The Bureau of Chemistry and Soils, United States Department of Agriculture, through the office of Soil Fertility Inves-

tigations, in cooperation with a number of Agricultural Experiment Stations, has been conducting some fertilizer experimental work to determine the comparative value of nitrogen fertilizer materials when used in potato fertilizers. These studies are being made chiefly in Maine, New York, New Jersey, Pennsylvania, and Virginia, on prominent soil types. The experimental work is being carried on largely in direct cooperation with potato growers, who furnish the land, the seed, and take the usual care of the crop.

Such studies are becoming increasingly important when it is realized that so many new nitrogen materials are being produced and offered to the fertilizer consumer. It is important that potato growers should know not only how much nitrogen can profitably be used in potato fertilizers, but how much should be derived from inorganic and how much from organic sources. The influence of the newer nitrogen materials on soil reaction the effect of the greater purity of the synthetic nitrogen materials the distribution and placement of mixed fertilizers containing these newer nitrogen compounds with reference to the potato seed-piece the specific action of the nitrogen salts on the seed-piece during a period of drouth, or when faulty placement of the fertilizer occurs, so that direct contact with fertilizer and seed-piece takes place and the relative leachability and movement of the newer nitrogen compounds after their application to the soil, have developed problems of great interest for those concerned with soil fertility and fertilizer investigations on potatoes.

The Effects of Seed Treatment on Black Leg

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The treatment of seed potatoes is now a routine practice followed by many growers. It is intended principally as a control measure in reducing the amounts of Common Scab, Rhizoctonia and Black Leg diseases in the potato crop.

For the purpose of securing some information on the actual results in controlling Black Leg that are being obtained by growers with their present methods of seed treatments, as practiced on the farms under commercial conditions, it was decided to assemble all available data specifying the treatment used and the percentages of Black Leg disease present.

SEED TREATMENT AND BLACK LEG INFECTION—1929

District	No Treatment			Bichloride			Formalin		
	Total Fields	Number of Fields Infected	Average % Infection	Total Fields	Number of Fields Infected	Average % Infection	Total Fields	Numbre of Fields Infected	Average % Infection
No. 1	2244	862	.93 %	2357	630	.70 %	78	32	1.0 %
No. 2	154	33	.52	5	0	0	186	27	.35
No. 3	582	370	.56	2	1	.50	30	16	.75
No. 4	1147	555	1.02	-----	-----	-----	434	177	.97
No. 5	259	209	1.17	182	116	.57	88	68	1.04
No. 6	63	28	1.13	7	3	1.33	-----	-----	-----
No. 7	91	22	1.71	19	4	1.25	51	19	2.09
No. 8	30	9	.63	4	1	2.0	78	12	1.18
No. 9	120	19	2.44	126	13	1.27	56	3	.56
Total	4690	2107	.93	2702	768	.72	1001	354	.99

AVERAGE LOSS OF CROP—

4690 growers did not treat ..... .42%
2702 growers treated with Bichloride ..... .20%
1001 growers treated with Formalin ..... .35%

The growers supplied the former information, and the field inspectors employed on seed potato certification work, the latter.

There were 8393 good reports used in compiling the data given in the table, and these reports cover representative potato growing areas in every province.

Much the same results were obtained in 1928 as the following figures indicate:

1928 RESULTS

No treatment, 3506 fields, average infection 1.2% Black Leg.

Bichloride, 2858 fields, average infection .73% Black Leg.

Formalin, 946 fields, average infection .94% Black Leg.

3506 growers did not treat. Average loss .57% of crop.

2858 growers treated with bichloride. Average loss .21% of crop.

946 growers treated with formalin. Average loss .32% of crop.

SUMMARY

(1) Seed treatments, as at present applied on farms, reduce but do not altogether control Black Leg.

(2) Bichloride gives better results than formalin.

(3) The growing season in 1928 was generally considered a wet season, and in 1929 a dry season. The results for the two years are fairly uniform when this difference in seasons is taken into account.

Breaking the American Record in Colorado

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For over twenty years the American record for potato production was held by R. A. Chisholm of Del Norte, Colorado, with eight hundred forty-nine bushels. It then moved to Stockton, California, but this year came back to the San Luis Valley of Colorado, being broken by L. G. Shutte of Monte Vista, Colorado, with the Brown Beauty variety, the same with which Mr. Chisholm established his record which he held so long

These high yields which have been obtained in Colorado are all in connection with the county "Potato King Contests" and

with the "Colorado 600 Bushel Club" which started in Rio Grande county in 1927, under the direction and supervision of the Agricultural College, and has since been taken up in three counties. The rules are practically the same as those used in Pennsylvania by the "400 Bushel Club." The contest acre must be selected by the grower from his commercial field or seed plot which must be at least five acres in size, the object of the contest being to stimulate better potato production and not to lead growers to devote time to a small plot just to make a record. The acre must be accurately measured with a steel tape and the corners staked by the County Agent and Farm Bureau committee. The number of rows dug depends on the shape of the acre and the number of rows in it. The rules specify the exact number of rows to be dug but it is always more than one-tenth of the acre. The digging and weighing is supervised by the committee.

In 1927 Rio Grande was the only county in the contest and 11 of the acres measured made over 600 bushels. In 1928 Rio Grande county had three and Garfield county one, Alamosa county one, and Montrose county six, making a total for the three years of twenty-six members. Nearly all commercial varieties grown in the state are represented in these 600-bushel yields. The varieties rank as follows:

Brown Beauty	13
Rural (Smooth and Russet)	5
Peachblow	6
Russet Burbank	1
Triumph	1
Totals	26

Mr. Shutte is the only man who has obtained a yield of over 600 bushels all three years, which also shows that breaking the record is no accident, but that his methods of production are based on sound principles. His yield has also increased each year, 777 bushels in 1927, 1047 bushels in 1928 and 1145.17 bushels in 1929. This past season his acre was measured from his seed plot, ten acres in size and he grew a total of one hundred ten acres of potatoes. This yield of 1145 bushels means an average of 4.6 pounds per hill. In the recent seedling trials in Scotland the best one yielded only four pounds three ounces per hill on a very small plot. Such a record merits the careful study of those interested in the potato industry. How were such yields obtained?

There are two sets of factors which enter into the production of these high yields: First, environmental factors such as climate and soil, and second, cultural factors such as rotation, fertilization, soil preparation, seed, method of planting, cultivation and irrigation. It is obvious that the grower has little or no control over the environmental factors but that

they have a very decided bearing on the yields obtained. It is in the cultural factors, which the grower controls to a large extent, that we find the key to larger production, especially the reason that one grower obtains much larger yields than his immediate neighbor.

Mr. Shutte's farm is located three miles from Monte Vista in the San Luis Valley of Colorado. This valley comprises five large counties and is as large as the state of Massachusetts. It is a high mountain valley, 7,600 feet above sea level, completely surrounded by high mountain ranges. It is 120 miles long, 60 miles wide and as level as a table. Geologists consider it an old lake bed. Monte Vista lies between 37 and 38 degrees N. latitude, approximately the same as San Francisco, Wichita, Kansas, and Richmond, Virginia. This is considerably south of the large center of potato production in North America, but the 7,600 feet altitude make conditions comparable to a latitude similar to that of Moorehead, Minnesota, or Presque Isle, Maine. The annual mean temperature is low, being about 42.4 ranging from a mean of 20 in January to 63 in July. The length of growing season is correspondingly short, averaging only about 105 days between killing frosts. The valley also has a very high percentage of sunshine, even more than the state average, which is around one hundred fifty-one clear days, one hundred fifty-three partly cloudy, and sixty-one cloudy. The annual precipitation is only about eight inches and comes mostly in July and August. As a result, the humidity is low, being only about fifty-three per cent. The precipitation is very heavy in the mountains which bound the valley, however, and several large streams provide ample water for irrigation. The Rio Grande river has its origin on the Continental Divide which forms the western boundary of the valley. This river flows southwest through the valley and flows through Mr. Shutte's farm. The water table in the valley is high and there are a good many artesian wells. A large percentage of the land is sub-irrigated. As in most western districts, which are not extremely highly developed, the average size of farm is large, being three hundred acres in Rio Grande county. The soil varies from a light sandy loam to a somewhat coarse gravel.

The soil on Shutte's place is somewhat heavier than the average soil in the valley, being a yellow sandy loam, underlaid with coarse gravel. The ten-acre plot from which Mr. Shutte selected his record breaking acre, is the same on which he obtained the 1,047 bushels last year. The basis for his rotation is alfalfa and this field previous to 1928 was in alfalfa ten years. In 1928 the field received a liberal application of manure, fifteen tons of well rotted horse and cow manure per acre. It received another application of manure in the spring of 1929. This time it consisted of one-half well rotted horse

and cow manure and one-half poultry manure, applied at the rate of fifteen tons per acre. Mr. Shutte is a firm believer in alfalfa sod for potatoes, although the general practice is sweet clover pastured or harvested for seed, followed by potatoes or field peas, followed by potatoes. The land was spring plowed to a depth of twelve inches, the sandy nature of the soil permitting spring plowing.

The usual practice in the San Luis Valley is the planting of small whole seed, consisting of potatoes which pass over an inch and one-half screen, but through a two-inch screen. These are later sorted over by hand, supposedly to remove degenerated tubers, but the method is not very effective as a disease survey shows. The selected tubers are oval to oblong in shape and quite pronouncedly flattened. As a general rule one thousand to fourteen hundred pounds of seed are used per acre. There are several reasons for the above practice: First, the use of these small culls materially reduce the cost of seed as they would otherwise be thrown away or fed to livestock; second, cutting costs are eliminated, and third, a better stand is assured because of the low rainfall and the fact that the ground is dry at planting time since sub-irrigation is practiced and the sub does not come up until late in June. It is here in the matter of seed that Shutte makes the greatest deviation from general potato production practice. For six years, previous to 1927, Shutte had bin selected seed with the utmost care and field rogued giant hills which are commonly known as "bastards." In 1928, he maintained a ten-acre seed plot from which he rogued mosaic, spindle tuber, rhizoctonia and blackleg. This procedure he repeated in 1929 on a thirty-acre seed plot with the result that the stock met the requirements for certification. He spent a great deal of his time during the winter personally hand selecting his seed. He did not select potatoes that went through a two-inch screen, but selected his seed from the smaller size markets, three to seven ounces in size and averaging about five ounces. He also picked a thicker, shorter type tuber with a deeper eye than any of the other growers picked. This type of seed produced fewer stalks per hill and much more vigorous vine growth than is common for this variety.

The planting was done with a machine assembled and corrected by Mr. Shutte. It consisted of three cup-style planters fastened to the same frame and so spaced to plant rows thirty-four inches apart. This outfit was drawn by a tractor and a man on each planter corrected the feed. These machines, as they come from the manufacturer, will not handle the size seed Shutte uses, the cups are too small and the seed spout is too small. The matter of the cups was taken up with the manufacturer who gave splendid co-operation and made some larger cups which gave excellent results. It was then necessary to

split the seed spout and enlarge it so that the large seed would drop through. The whole tubers were dropped twelve inches apart and very accurately as at least a 96 per cent stand was secured. It was possible to plant about twenty acres per day with this outfit. The planting was done the middle of May and the tubers were planted five inches below the ground level.

The land received one harrowing and one dragging. It was possible to cultivate only twice as the vine growth was tremendous and formed a solid mat on the ground. The vines averaged six feet in length by actual measurement and some were eight feet long. They are spreading in habit and lay over the ground instead of standing erect like the Rural, Peachblow or Russet Burbank. The stems are firm but not hard. The stems are usually small but in this case were one-half inch or more in diameter. The Brown Beauty usually blooms quite freely, but this field showed only a scattered bloom. This variety sets very heavily, as high as thirty-five marketable tubers being obtained from one hill. As a result there are no overgrown tubers and they are quite uniform in size. Shutte had selected over two thousand sacks of seed which was planted at the rate of twenty-four hundred pounds or forty bushels per acre on his entire acreage. The seed plot, however, was planted closer and forty-seven bushels or 2,820 pounds was required. On the second cultivation the potatoes were hilled with a disc cultivator with the result that there were very few sunburns. The land was sub-irrigated.

An early frost killed the vines on September 7th, which is about two weeks early even for this locality. The crop was dug the first week in October, the digger being drawn by a tractor. The widest mouth digger obtainable was used but even then it did not efficiently handle this crop, the tremendous vines and large number of tubers making it a very difficult job. Some individual hills in the field produced nine pounds of potatoes. This leads us to believe that 1,500 or even 2,000 bushels can be produced on an acre, even under our extensive method of production. This will require a little more seed selection and a more favorable season than either of the last two have been, but when it occurs Mr. Shutte will have another record which will be hard to beat.

A summary of the factors contributing to this yield shows:

1. Ideal soil and climatic conditions.
2. A crop rotation with potatoes on the same ground once in five years.
3. Alfalfa sod land and barnyard manure as soil improvers.
4. A definite program of seed improvement and maintenance.
5. Thicker, shorter, slightly rougher seed planted whole.

6. An extremely large seed piece (5 ounce average).

7. Twenty-eight hundred pounds, forty-seven bushels of seed per acre.

Michigan Master Potato Growers' Contest, 1930

J. J. BIRD, Michigan State College, East Lansing

The idea of contest is basic in all sports, and since there is a certain element of sport in all phases of agricultural production, because of its competitive character, it is only natural that contests should hold such an important place in all our exhibitions. The corn-husking contest has become a statewide institution. The hog ton-litter effort is a fine example in the animal husbandry line, to say nothing of cow test records in dairying, etc.

It is no wonder then that the potato, one of our most important cash crops and staple food commodities, should be the subject for contest production especially since the establishment of potato certification and general standardization the country over.

We hear of Mr. Schutte's record field in Colorado, and from the standpoint of production alone we must hand it to him as "National Potato King." In New York we find a premier potato growers' contest based upon low cost of production, yields of U. S. No. 1, and total yields per acre, ranging in importance in the order named.

Michigan Master Potato Growers' Contest originated last year at one of the district potato shows, which proved to be a real success, creating much interest despite the unfavorable season for Michigan growers in 1929. The contest is to have a definite place in the potato extension program for Michigan, and this year it is to be made available to every potato grower in this state, whether certified or table stock grower by being conducted as an elimination process in all of the six district potato shows, with the final contest at the State Show held at Michigan State College during Farmers' Week, the first week in February.

Because of the growing necessity of high production per acre to result in low production cost per bushel, and because of the appeal for market quality potatoes, it is felt that these two points should largely determine the ability of the indi-

vidual to be a master grower. The contest is based upon five points with their importance as follows:

Total production per acre—125 points.
Field run quality—125 points.
Ability to select types—100 points.
Ability to grade—75 points.
Cost of production—75 points.

College supervision in the fields at digging time will certify to the yields and also to the picking of the 150 pound sample of field run stock to be used to determine quality. Each contestant is also required to exhibit 32 potatoes in the open class to determine his ability to select types for show stock. He will also be required to grade a given sample of potatoes into regular U. S. grades, which also adds a feature of interest to the show. The points on cost of production will be partly based upon the completeness of the cost account record kept and on the actual cost of production per bushel. The last point, or cost of production, is a very variable figure, because of very irregular potato growing conditions in Michigan, and in fairness to the individual as a master grower, the cost of production does not rate highest, as in some contests.

The district elimination in the Michigan Master Growers' Contest starts with the Upper Peninsula Potato Show scheduled for October 23rd, 24th and 25th. The Top-O'-Michigan Show at Gaylord follows in October on the 29th, 30th and 31st. Both the Western Michigan Potato Show at Reed City and the Thumb of Michigan Potato Show at Mayville will be held November 5th, 6th and 7th. The dates of the Greenville Show and the Southwestern Michigan Potato Show at Kalamazoo have not been set at the time of this writing.

Each of these district shows provides a prize for each local winner and contributes a certain amount toward a grand prize for the winner at the State Show, the money to be used to defray expenses on an annual out-of-state potato tour.

Crop and Market News

(Contribution from Bureau of Agricultural Economics)

Continued heavy supplies of potatoes were depressing the market in mid-July. Demand was rather weak, and trading showed only moderate activity. With Virginia shipping an average of 650 cars daily and large crops also moving from

Kansas and Missouri, the total output each day was averaging around 900 or 1,000 cars. North Carolina had completed a heavy movement of 7,500 carloads.

The Norfolk section of Virginia was hunning ahead of its last year's record, but Eastern Shore was lagging behind its corresponding totals for 1929. Mid-western crops moved much earlier and in heavier volume than last season. New Jersey and Long Island expect large crops of potatoes, and the season in those sections will open during late July. Early potatoes will soon be moving from the northern or main-crop States.

Prices everywhere had declined very sharply from those of the month before. This may be due in part to the general depression in business conditions. Bottom of $2.25 per barrel of best Cobblers had been reached at shipping points on the Eastern Shore of Virginia, but some improvement was expected as soon as peak shipments were completed. Cash-track prices of sacked Cobblers in Kansas and Missouri ranged only $1.10-$1.15 per 100 pounds. These potatoes were selling in the Chicago carlot market at $1.50-$1.65, while the general jobbing range on eastern stock was $2.50-$3.50 per barrel. Old potatoes had finished with a seasonal record of 187,200 cars from the 19 most important shipping States. This is about 11,000 more than for the 1928-29 season.

HEAVIER CROP THIS YEAR

The July 1 estimate of 1930 plantings of potatoes totals 3,482,000 acres for the United States. This is an increase of three and one-third per cent over both the 1929 acreage and the previous five-year average. Increases in Southern States average about 13 per cent. There is little change in acreage in the North Central States, where a material increase in Wisconsin has been offset by decreases in Minnesota and the Dakotas. Changes are small in the North Atlantic States outside of Maine, where the acreage for 1930 is estimated to be the largest on record.

Condition of the potato crop on July 1 was 83.4 per cent, compared with 83.1 per cent on the same date in 1929 and 85.5 per cent, the average condition on July 1. Present indications point to a crop totaling 398,000,000 bushels, compared with 360,000,000, the revised estimate of 1929 production, and a five-year average of 393,000,000 bushels. In the Southern States the expected crop does not differ materially from that of last year, in spite of the material increases in acreage. The expected crop in the North Central States, where yields were light in 1929, is 28,000,000 bushels greater than the crop harvested last year. The North Atlantic States and Western States expect increases of 7,000,000 and 4,000,000 bushels respectively.

United States Department of Agriculture
New England Crop Reporting Service
July 12, 1930

United States Potato Acreage 3.3 Per Cent Above Year Ago

The July 1 estimate of 1930 plantings of potatoes totals 3,482,000 acres for the United States. This is an increase of 3.3% over both the 1929 acreage and the previous five-year average. Increases in southern states average about 13%. There is little change in acreage in the north central states where a material increase in Wisconsin has been offset by decreases in Minnesota and the Dakotas. Changes are small in the North Atlantic states outside of Maine where the acreage for 1930 increased by 5% to 188,000 acres.

Present indications point to a United States crop totalling 398,419,000 bushels compared with 359,796,000 bushels the revised estimate of 1929 production and 392,605,000 bushels the average 1924-1928. The 1930 prospective crop is about 11% larger than the 1929 crop and 2% above the overage.

In New England a total of 251,000 acres have been planted to potatoes this year compared with 241,000 acres harvested in 1929 and 212,000 acres the recent five-year average. The increase in the planted acreage is largely in Maine as only one other state, Massachusetts, shows a slight increase. Acreages in the other New England states remained unchanged. The present outlook in New England is for a crop of 55,630,000 bushels or about 6% below the 58,988,000 bushels harvested in 1929 but about 17% above the average of 47,400,000 bushels. This year's crop started under favorable conditions in all parts of New England and has made rapid growth. In Aroostook county potatoes are already coming into bloom. Some growers expect shipments to begin about ten days earlier than usual if the marketing situation is favorable. An excess of rainfall in the form of frequent heavy showers in Maine and Vermont has caused some damage to hillside fields and may have leached out a large amount of fertilizer.

Production in Maine is likely to be 6% below that of 1929 but 22% above average. The eight major late crop states (Maine, New York, New Jersey, Pennsylvania, Michigan, Minnesota, Wisconsin, North Dakota) have expectations of potatoes exceeding their 1929 production by 18% and the average of 3%. Production in the 20 late states (the above eight and South Dakota, Nebraska, Montana, Wyoming, Colorado, Idaho, Utah, Nevada, Washington, Oregon and California) is expected

to exceed that of 1929 by 15% and the average for the past five years by 2%. In nearly all these states the crop is making good progress. In the eastern group plantings were early but owing to excess moisture early blight is showing up. Dry weather in some of the western states has held the crop back; also a late freeze has done some damage in the Rocky Mountain area.

In the southern early states (Virginia, North Carolina, South Carolina, Florida, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, New Mexico and Arizona) combining their early and late production, have about 4% more potatoes than a year ago and 10% more than usual. The deficient states (Delaware, Maryland, West Virginia, Ohio, Indiana, Illinois, Kentucky, Iowa, Missouri, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut) show an indicated production about 4% below that harvested in 1929 and 10% below the 1924-1928 average crop. Dry weather in nearly all of the states in these two groups has materially cut prospects for the late crops.

C. D. STEVENS,
C. D. BURMEISTER,
Statisticians.

Notes

NEBRASKA

Preliminary Announcement and Schedule Annual Western Nebraska Potato Tour—August 18-21 Inclusive

August 18—Assemble at county agent's office, 8:00 a. m. Drive to certified potato fields about Kimball. Picnic dinner near Bushnell. Visit to fields about Bushnell. Drive to Scottsbluff, 4:00 p. m., for night.

August 19—Assemble at Lincoln Hotel at 8:00 a. m. Visit fields near Scottsbluff. Stop at experiment farm for lunch. Review work at experiment station. Drive to Alliance for night.

August 20—Assemble at Alliance Hotel at 8:30 a. m. Visit fields west and north of Alliance. Lunch at Box Butte experiment farm. Grand opening of experiment farm in afternoon. Aliance overnight.

August 21—Assemble at Alliance Hotel at 8:00 a. m. Arrive Hemingford by 8:45 visiting fields about that vicinity until 10:00 a. m. Lunch at Cook Ranch, Agate, Nebraska, at noon. Afternoon spent in visiting Indian museum and fossil beds on Niobrara river. Tour disbands about 4:30 p. m.

All out-of-state visitors will be provided transportation, though the office of Nebraska Certified Potato Growers, Alliance, should be advised in advance if possible.

We should like all potato growers to feel that this is their tour, and not exclusively the Certified Potato Growers. There will be something of equal interest for you if you are in the potato game, be it for certified seed or table stock.

NEBRASKA CERTIFIED POTATO GROWERS.

Review of Recent Literature

Whole vs. Cut Seed

Extract from Report of Experiment Conducted in British Columbia by H. S. MacLEOD.

The object of this experiment was to compare the yields obtained from crops planted with whole seed to those planted with cut seed, using the same variety and under the same conditions, and to determine the difference, if any, in yields. Many of the growers claim that on soils that are rather wet and cold at time of planting, and liable to remain thus for some time afterwards, it does not pay them to plant cut seed, as it will rot in the ground to a considerable extent and thus reduce the yield.

Our Whole vs. Cut Seed experiment at Sumas in 1928 indicated that this is quite correct. The yields given at Sumas were: Whole Seed 15.2 tons per acre and Cut Seed 4.6 tons per acre.

In 1929 we repeated this experiment on Lulu Island. The variety used was Irish Cobbler, certified seed. For both whole and cut seed the weight of seed piece was the same (3 oz.),

all were planted on the same day, given the same treatment, same cultivation, and were dug on the same date. All conditions were as uniform as was possible to obtain in that field. The yields were as follows, in tons per acre:

	Marketable	Unmarketable	Total
Whole Seed	8.338	1.923	10.261
Cut Seed	6.222	1.600	7.822

The difference in yields is not as great as it was in this experiment in 1928, owing to the fact that in that year the soil was much more wet and colder at time of planting, and consequently the cut seed then rotted in the ground to a greater extent. However, an increase of over two tons per acre (2.439) is quite considerable. This experiment indicates that it is advisable to plant whole seed rather than cut seed in soils that are rather wet and cold at time of planting. These conditions are typical of a very large portion of the potato growing sections in this province.

—J. T.

Mooring, D. C. Potatoes Pay in Oklahoma.—Better Crops with Plant Food. 14: 17, 18, 57 and 58. May, 1930.

It is claimed that Oklahoma potato growers have come to recognize and practice certain essential requisites such as fall plowing, use of legumes, intelligent application of commercial fertilizer, good seed used liberally and better cultural, harvesting, grading and cooperative marketing methods. As a result of these better practices Oklahoma's acre yield of potatoes has been increasing. Examples are given of the benefits derived from turning under leguminous crops and of the intelligent use of commercial fertilizers. One of the striking examples given which is cited as "Demonstration No. 1" is as follows: E. M. Durland of Hugo planted Triumph potatoes in 1928 on land that had previously grown cotton. He applied 600 lbs. per acre of a 4-8-6 fertilizer and produced 165 bushels. The potatoes when harvested were followed by cowpeas which were turned under that fall. In 1929 this land was again planted with the Triumph potato and the same amount of a 4-8-6 fertilizer applied. The yield was 322 bushels per acre. Comparative tests of certified and uncertified Triumph seed were also conducted with the following results:

Case No. 1: Certified 160 bu. per acre; uncertified 40 bu. per acre.

Case No. 2: Certified 246 bu. per acre; uncertified 116 bu. per acre.

Several examples are given showing beneficial results from the use of commercial fertilizers.

—W. STUART.

Wilkinson, A. E.—Potatoes in England.—Better Crops with Plant Food 14: 43, 44, 60, May, 1930.

The author furnishes an interesting account of potato growing methods practiced in the Lancashire district in England. It is claimed that this district produces 20 per cent of the total potato crop of England. The average acre production on some of the best farms during the past 10 years was about 260 bushels. The common rotations in this district are potatoes followed by winter wheat, then grass or oats to be again followed by potatoes. Grass land is generally fall plowed, otherwise it is generally spring plowed. Stable manures when used are commonly applied in the furrow at the rate of 15 tons per acre. A hiller is used to cover the manure with soil. Commercial fertilizers, consisting of a mixture of 2 parts superphosphate, 1½ parts sulphate of ammonia, 1 part sulphate of potash and ½ part of steamed bone are also used. An application of 700 lbs. of this mixture is made where manure is used rather liberally or 1200 lbs. where it is used sparingly or not at all. The growers use about 1500 lbs. of seed per acre, or 25 bu. Late varieties are usually planted in March and early varieties in April. The early varieties are generally sprouted before planting while the late ones are not. Seed is cut just before planting. Planting is either by hand or with a one-horse two-man planter. Rows are spaced 27 in. apart and seed pieces 18 in. apart in row in the case of late varieties and 10 to 12 in. apart for early varieties. The growers have little knowledge of spraying and are little troubled by insect pests. The crop is graded over a 1⅝ in. screen and the small tubers are usually fed to livestock. The cost of growing an acre of potatoes was found to be approximately $175, while a few growers claimed their costs exceeded $200 per acre.

—W. STUART.

Bonde, R., D. Folsom, and ***E. R. Tobey.*** Potato spraying and dusting experiments 1926 to 1928. Maine Agric. Exp. Sta. Bul. 352. p. 97-140. 2 fig. 1929.

The experiments were made in Maine in Aroostook County, where there is a combination of northern and seaboard conditions not found elsewhere. In 1926, one application of 5-5-50 Bordeaux mixture made through error on a check plot on August 25, controlled late blight about as well as the regular series of 7 applications, and was associated with the highest yield rate in the series of plots. In another series, the sprayed plots lived until frost-killed, about 10 days longer than the controls. In both series insect control was not important and

the gain in yield rate from spraying was not significant. In 1927, late blight was severe, was controlled by Bordeaux mixture with a significant increase in yield, was nearly controlled by a colloidal-copper spray much weaker in copper than the Bordeaux mixture with a significant increase in yield, was controlled by copper-lime dust with yield undetermined, was nearly controlled by sodium fluosilicate spray, was less under control with a given spray schedule as check plots were more numerous, was evidently initiated by air-bore spores, and was spread rapidly from the occasional initial centers of infection. Insect control was not important. In 1928, late blight was still more severe than in 1927, with results like those of 1927 except that collodial-copper spray containing half as much copper as the Bordeaux mixture equalled the latter, a commercial dried and powdered Bordeaux mixture used both as dust and as spray was about as effective as Bordeaux mixture, and sodium fluosilicate, when mixed with hydrated lime to reduce the foliage burning by the former, did not control the disease. In the three years, rot in the field and even in poorly ventilated bins together affected less than 10 per cent of the crop. In 13 years' tests with Green Mountains, on the average the yield of untreated plots is 323 bushels an acre and the gain from Bordeaux spraying is 26 bushels or 8 per cent. In five years' comparisons, on the average, copper-lime dust increased the yield rate 18 bushels as against an increase of 16 bushels an acre with Bordeaux spraying, over the control rate of 332 bushels. The plot replication in these tests shows that the plot technique was inadequate in many comparisons made elsewhere. Comparisons made elsewhere, as reported, were found to relate instances of copper fungicides reducing the yield rate of potatoes even when extending the life of the plants. It was shown that a device for pushing aside the potato plants in front of the wheels of the spray-rig, can increase the yield rate significantly. The apparent vigor and yielding power of potato plants was not influenced by the use or nonuse of copper-containing spray materials on the preceding parent generation. The omission of the first three of the regular series of eight applications of Bordeaux mixture or of copper-lime dust, in 1928 was accompanied by more late blight, generally superior foliage, and 20 bushels' increase in yield per acre. Leaf analyses showed about twice as much copper accumulating with Bordeaux spraying than with copper-lime dusting. Mild mosaic increased susceptibility of the foliage to late blight. In 1927 there was a distinct lessening of injury by late-blight rot, in commercial shipments, at about September 16. Soil differences affect the severity of late blight on foliage and tubers. Some apparent causes of ineffectiveness of commercial

spraying were observed. Such spraying varies with the location with respect to results including profits. All spraying varies in effectiveness and other results according to seasonal conditions.

—DONALD FOLSOM.

Pieper, J. J., W. L. Burlison and ***W. P. Flint.*** Growing Potatoes in Illinois. Ill. Agr. Exp. Sta. Bul. 344, pp. 243-283, Apr. 1930.

The authors state that potato growing in Illinois is concentrated in the three northern tiers of counties and in three counties near St. Louis. It is claimed that the average annual consumption of potatoes in Illinois is 20 millions of bushels in excess of its production which is approximately 5½ millions of bushels. The general requirements for good yield are discussed under "Climatic Requirements"; "Fertile Soil"; "Soil Management"; "Crop Rotation" and "Seed Bed Preparation." Results of fertilizer studies and of variety trials are given. Other subjects discussed are cutting seed, early planting; depth, rate and distance of planting; cultivation, mulching, harvesting and storing; late potatoes for storage; avoidance of bulk storage; temperature and humidity; ventilation and light; proper storage essential for good seed; machinery; diseases and their treatment; insects and their treatment; spraying and dusting experiments, etc.

The authors' conclusions in regard to getting better yields are in part as follows:

Potatoes can be made a more profitable crop in Illinois with the adoption of better culture practices. Bordeaux mixture added either as a spray or dust to arsenate of lead will increase yields on the average about one-third. When insects and diseases are prevalent yields may be increased 50 to 100 per cent. Northern-grown seed potatoes were found decidedly superior to home-grown. An average of 50 trials extending over 12 years showed an increase of 11.8 per cent.

Cobbler and Early Ohio varieties are considered best for early and Carman No. 3 for late crop.

Barnyard manure gave the most consistent and largest increase of any fertilizer. Most soils of the state were found to contain sufficient potassium.

—W. STUART.

Jehle, R. A. and ***E. I. Oswald.*** Tests with Potato Seed from Various Sources. Md. Agr. Exp. Sta. Bul. 317 pp. 231-254, Nov. 1929.

The object of this experimental study was to determine which seed stocks would produce the best results in Worcester

County, Md. The tests were conducted on three different farms during the years 1924 to 1928 inclusive. Each of the three farms represented distinct soil types,—sassafras sandy loam, sassafras fine sandy loam and sassasfras loam. The Irish Cobbler variety was used throughout. Three distinct kinds of seed were used,—northern grown, mountain grown and fall grown. In the course of the experiment northern grown seed was procured from Maine, Michigan, Minnesota, New Brunswick, New York, Prince Edward Island and South Dakota; mountain grown seed from Western Maryland and Virginia; fall grown seed from Maryland and New Jersey.

The results of the five-year tests showed that the average yield of the northern grown certified seed was 265.2 bu. per acre. Mountain grown certified seed averaged 220.4 bu. per acre; fall grown certified seed 209.3 bu., while uncertified seed only yielded an average of 186.1 bu. per acre. The authors state that the most significant conclusion to be drawn from the tests is that health and vigor of the seed stock is the most important factor which influences its productivity.

—W. STUART.

Hardenburg, E. V. Experimental Studies of Muck Soil as Affecting Seed and Table Quality in Potatoes. Proc. Am. Soc. Hort. Sc., (1929) pp. 214-220, 1930.

Six varieties were used in 1929 viz.: Early Ohio, Irish Cobbler, Spaulding Rose, Green Mountain, Rural New Yorker and Russet Rural. With the exception of the Early Ohio, which was muck grown in 1928, and contained considerable leafroll, the seed used in 1929 was produced from 1927 certified seed grown on upland soil in 1928. The 1929 test was conducted on muck and upland soil at Marion, N. Y. and on upland soil at Ithaca, N. Y. Disease readings on both types of soil were made and the following additional data taken; average number of stems and tubers per seed piece; average total yield in bushels per acre and of percentage of U. S. No. 1's. The conclusions of the author were (1) that a larger number of tubers per plant were developed on the muck soil; (2) that there was a marked difference in varietal susceptibility relative to the occurrence and spread of virus diseases, dependent on soil type; (3) the total and U. S. No. 1 yields were generally, though not always, correlated with virus disease content; (4) there was no definite effect of soil type on either starch or nitrogen content of the tubers or starch-nitrogen ratio; (5) there was no definite relation of composition to culinary quality as affected by soil type.

—W. STUART.